3.16 HEALTH AND SAFETY

3.16.1 Impacts of the Proposed Action

3.16.1.1 Risk of Fire and Explosion

Fire Risk
Unlike thermal power plants, wind power projects pose a much smaller risk of explosion or fire potential, as there is no need to transport, store or combust fuel to generate power. As with any major construction undertaking, construction of the Project does present some fire risks. Fire risk mitigation starts with Project design, especially with electrical design that needs to comply with the National Electric Code (NEC) and the National Fire Protection Agency (NFPA). A strict fire prevention plan will be enforced both during construction and operations to mitigate fire risks.

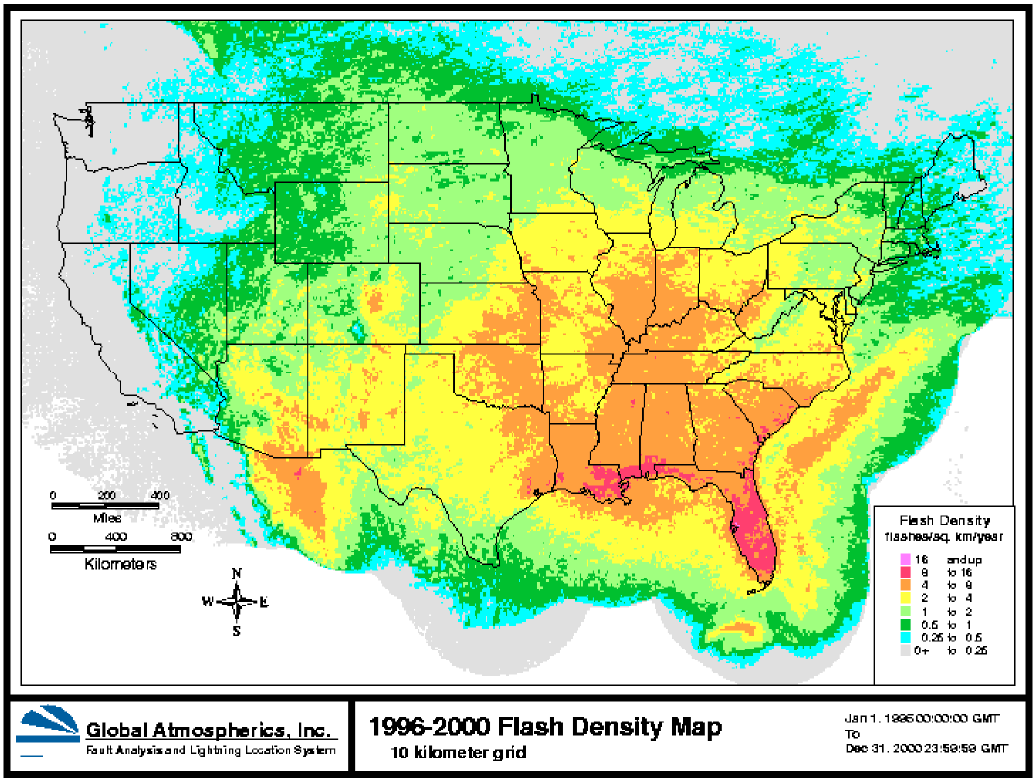
Given the fact that there are only three residences within 2 miles of the Project site and there are no valued timberlands or residences downwind of the Project site for more than 10 miles at which point the land reaches the Columbia River, the risk of unintentional or accidental fire or explosion during both construction and operations spreading to sensitive areas is minimal. As the Project site is generally arid rangeland with a predominant groundcover of grasses and sagebrush, the highest expected fire risks are grass fires during the hot, dry summer season. Fire risk potential is constantly tracked and reported during the summer fire season by the DNR and this will be actively posted at the construction job site during the high risk season. The Project site roads act as firebreaks and also allow for quick access of fire trucks and personnel in the event of a grass fire.

The Applicant is in the process of determining which Fire District will be responsible for fire protection services for the Project and will submit this information as part of the Fire Protection and Prevention Plan to EFSEC prior to construction. EFSEC, as well as the appropriate local fire district will review and approve all plans before they are implemented. The Fire Protection and Prevention Plan will include specifics regarding range fire prevention and property protection.

Lightning
Lightning induced fires are rare in the Project area. As shown in the flash density map in Figure 3.16.1-1, the Kittitas Valley and interior Washington in general, is not a highly lightning prone area. In fact, this area falls in the second lowest of eight categories of lightning intensity. The map is based on data from lightning flash sensors installed nation-wide over a four-year period. Since the wind turbines will be the highest structures in the surrounding area, the probability of lightning strike may be higher, however, the mitigation measures in place are designed to mitigate this risk significantly.

Both the wind turbine generators and the substation are equipped with specially engineered lightning protection systems, as described in Section 2.2.5, 'Construction Methodology'.

Figure 3.16.1-1: Lightning Flash Density Map of the USA



Turbine Fires

As is the case with almost any complex machine, there is some potential for fire inside the wind turbine generators. With the types of modern wind turbines proposed for the Project, however, turbine malfunctions leading to fires in the nacelle are extremely rare. The turbine is equipped with several thermal couple type temperature sensors to detect overheating of turbine machinery. Internal fires would be detected by these sensors and the turbine's control system causing the machine to shutdown immediately and send an alarm signal to the central SCADA system which would notify operators of the alarm by cell phone or pager.

One very useful source of information regarding the risks associated with operating wind Projects is the insurance industry. The Applicant contacted Worldlink Insurance in Palm Springs, CA to gain comparative information regarding the types and degree of risk associated with wind power Projects. Worldlink stated that they insure over 17,000 WTGs, and that principals at the company had 15 years of experience with the wind industry. They stated that fires from wind turbines were very rare, averaging approximately two to three incidents per year among the 17,000 turbines insured by the company. This translates into a rate of one fire per 4,000 to 6,000 turbines. Worldlink also noted that the vast majority, approximately 85-90%, of those fires were related to older (i.e. pre-1995) wind turbine technology. Perhaps most importantly, they stated that the firm had only one third-party claim ever, which was for a haystack that burned on a neighbor's property as a result of a fire related to an older wind Project in Altamont, CA.

There is little to no potential for nacelles to catch on fire during construction, as they will not be operating yet. In the event of a nacelle fire, Project operations staff and fire personnel will not attempt to climb the tower to put it out, but only prevent the fire from spreading to any adjacent land. This will be achieved either by use of fire suppressant material or a small controlled burn around the base of the tower out side of the graveled area that surrounds the tower base.

Substation Fires

As substation transformers are filled with mineral oil, they present a potential fire risk. The substation will be constructed and designed with a very robust grounding system to mitigate lightning strike damage potential as described in detail in Section 2.2.4, including an underground grounding grid with multiple grounding rods and direct buried copper cable as well as overhead shielding wires which span across the steel pole structures to provide a cone of protection over the entire substation.

Substation transformers will be surrounded by a containment trough filled with heavy, nonflammable gravel which will limit the amount of oil exposed in the event that an oil leak from the transformer tanks combines with a fire. By reducing the surface area of a potential mineral oil spill, the containment trough reduces the fire hazard potential from the oil.

Fire Risk During Decommissioning

The potential fire risks during decommissioning and construction are similar in nature, but are lower for Project decommissioning. Fire prevention measures during decommissioning would be substantially similar to those for Project construction.

Handling Medical Emergencies Associated with Fires and Explosions

Medical emergencies will be normally handled by calling 911 and alerting the EMS (Emergency Medical Services) system. The City of Ellensburg fire department provides emergency medical services (EMS) for the entire county, directly billing for services that include treating, burns, fractures, lacerations, fall injuries, and heart attacks. Ambulances are located in Ellensburg, and the towns of Kittitas. Also, Cascade Search and Rescue is located in Ellensburg. Emergency calls are dispatched through the Sheriff's office to the fire districts that provide search and rescue support.

Kittitas Valley Community Hospital in Ellensburg serves the entire county. The hospital has Level Four trauma service, with a limited number of specialists available. Patients with head injuries, severe burns, and/or trauma are transported to a different facility, usually Harbor View Medical Center in Seattle. Less severe accident victims are sometimes transported to Yakima for hospitalization and treatment. There is a heliport on the roof of the hospital, and a helicopter is available for emergency response (Eric Jensen, Kittitas Valley Community Hospital administrator, personal communication). MedStar, a critical care transport service located in Moses Lake, Washington, also provides air ambulance support services to Kittitas County.

All operations personnel, working on the turbines, will work in pairs. All turbine maintenance staff will be trained in lowering injured colleagues to prepare for the possibility of an injury while working in the nacelle that prevents a worker from climbing down the tower safely. A rescue basket, especially designed for this purpose, will be kept at the operations and maintenance facility and will be available for use by local emergency medical services personnel. Training in its use will also be provided to local EMS personnel.

3.16.1.2 Electromagnetic Fields (EMF)

EMF is associated with electric transmission and is not specific to wind power Projects. Electromagnetic fields are only ever considered a possible issue when associated with the siting of high voltage (115kV+) overhead transmission lines in close proximity to residences.

EMF at Wind Turbines
EMF is generally not an issue related to wind turbines, which have low voltage drop-cables (575 – 690V) contained within steel towers and have a predominately underground collection system also at a low voltage (34.5 kV), all of which is located more than 1 ¾ miles from the nearest residences.

EMF from Transmission Feeder Lines
For this Project, EMF exposure is very low because the line passes over and through undeveloped land. The high voltage transmission feeder lines have been sited along a path which does not bring them close to nearby residences or developed areas where people spend time. The closest residence is approximately ¼ mile from the PSE feeder line as illustrated in Exhibit 15-A, 'Residences in Project Vicinity Map'. The feeder lines will be designed and built according to industry standards to avoid any potential EMF impacts. Exhibit 34 contains a detailed EMF report prepared by TriAxis Engineering which estimates the peak EMF levels at various intervals including the peak EMF on the edges of the proposed 230 kV transmission line right-of-way (a distance of 75 linear feet from the transmission line centerline) to be 19.6 milli-Gauss for the magnetic field and 0.56 kV/m for the electric field as indicated in Table 1 of Exhibit 34. Based on the TriAxis report, the highest EMF levels expected at the nearest residence at a distance of more than 1,000 feet from the transmission lines will be less than 0.12 milli-Gauss for the magnetic field and 0.001 kV/m for the electric field. Average magnetic-field strength in most homes (away from electrical appliances and home wiring, etc.) is less than 2 mG. Very close to appliances carrying high current, fields of tens or hundreds of milligauss can be present.

Electric Shock Potential

Due to the distant proximity of the proposed transmission line routes to any residences or metallic structures, nuisance shock potential caused by induced EMF is very low. In areas where the transmission feeder lines runs parallel to existing wire fence lines, the fence line will be grounded with a copper grounding rod and ground straps at adequate intervals (typically every 1,000 feet depending on the fence line and soil conditions) to reduce the potential shock hazard from induced EMF in the fence wire.

3.16.1.3 Spillage Prevention and Control – Releases of Hazardous Materials

Construction Spill Prevention, Containment and Control Plan
This section describes measures that will be taken to prevent and mitigate any accidental spills or discharges. A detailed construction spill prevention plan will be developed by the EPC Contractor and submitted to EFSEC for review prior to construction. EFSEC, as well as pertinent local emergency response organizations, where appropriate, will review and approve all plans before they are implemented. The plan will address prevention and clean up of any potential spills from construction activities.

Construction of the Project will require the use of diesel and gasoline fuels for operating construction equipment and vehicles. Measures to prevent and contain any accidental spills resulting from this fuel storage and use are described below.

Petroleum fuels are the only potentially hazardous materials that will be used in any significant quantity during construction of the Project. Construction of the Project will require the use of diesel fuel for operating construction equipment and vehicles. Measures to prevent and contain any accidental spills resulting from this fuel storage and use are described in detail in below in '*Construction Spillage Prevention'*. Construction of the Project will not result in the generation of any hazardous wastes in quantities regulated by state or federal law.

Construction Spill Prevention:
Fuel and lubricating oils from construction vehicles and equipment and the mineral oil used to fill the substation transformer(s) are the only potential sources for a spill. The EPC contractor will be responsible for training its personnel in spill prevention and control and, if an incident occurs, will be responsible for containment and cleanup.

Fuel Spill Prevention:
During construction, the EPC contractor will utilize fuel trucks for refueling of construction vehicles, fuel storage tanks and equipment on site. The fuel trucks will be properly licensed and will incorporate features in equipment and operation, such as automatic shut off devices, to prevent accidental spills. Fueling of large, heavy construction equipment such as cranes and earth moving equipment will occur on site where the equipment is located. The fuel truck will drive to the equipment. Some construction vehicles, such as pick up trucks, will be fueled in town at gas stations. Any spills will be addressed in accordance with the construction spill prevention plan that will be developed by the construction contractor and will be submitted to EFSEC for review and approval prior to construction**.**

The risks associated with driving fuel trucks along gravel roads at the Project site are low. The road slopes are shallow enough to allow heavy WTG delivery trucks access to all WTG strings, and can safely accommodate fuel trucks as well. The roads are designed for wide loads and are a minimum of 20 feet wide, with a 2-foot shoulder on either side. Roads between contiguous turbines in a string will be 34 feet wide to accommodate large turbine erection cranes. Most roads are along ridges where slopes are typically less than 5 degrees. In areas of steeper grades, a cut and fill design will be implemented to keep grades below 15% to facilitate access and help prevent erosion.

Potential risks will be additionally mitigated by using dedicated fuel-delivery trucks driven by professional, appropriately licensed drivers and by ensuring adherence to the Project site speed-limits. No other equipment fueling plan is anticipated. A fuel tanker accident would trigger activation of the Spill Prevention Controls and Countermeasures (SPCC) plan. The SPCC plan will include a description of procedures that will be followed in the event of a fuel tanker spill and will contain a list of equipment that will be on site for spill response emergencies.

Lubricating Oils

Lubricating oils used during construction will mostly be contained in the vehicles and equipment for which they are used. Small quantities of lubricating oils may also be stored in appropriate containers at the construction staging area located at the site of the O&M facility. The details of storage and containment of lubricating oils and other materials at the construction staging area will be addressed in the construction spill prevention plan, which will be developed by the construction contractor and submitted to EFSEC prior to construction for review and approval. Appropriate measures will be taken to ensure these materials are not spilled and that if a spill does occur, it is promptly cleaned up and reported to the proper agencies.

Transformer Mineral Oil

The Project will have a substation with one or two substations transformers, which need to filled with mineral oil on site as they are delivered without oil in the tank. The main transformers(s) will be filled and tested as part of the commissioning process. The oil truck will be properly licensed and will incorporate several special features in equipment and operation, such as automatic shut off devices, to prevent accidental spills. The substation transformers have a specifically designed containment system including a full perimeter containment trough large enough to hold all of the oil from the transformer in the event of a tank breach.

Pad mounted transformers or transformers mounted in the turbine nacelles will be filled at the factory and not at the site during construction.

The construction spill prevention plan, which will be submitted to EFSEC for review and approval, will address prevention and clean up of any potential spills from construction equipment.

Worst Case Scenario

A worst-case hazardous materials scenario, while difficult to determine, might occur during construction and involve the catastrophic failure of one of the on-site, 1,000 gallon, diesel fuel storage tanks, perhaps by collision with a fully-loaded fuel-tanker truck. Assuming, as the worst-case scenario must, that the two fuel vessels and the containment tank are ruptured and that sustained exposure to a high-temperature ignition source is sufficient to cause ignition of associated vapors, there is a remote possibility that the ensuing combustion would ignite the fuel. Assuming that the fuel storage tank was full when ruptured, approximately 2,000 gallons of diesel fuel would burn and be difficult to extinguish. Even if such a scenario occurred during the dry season, it is unlikely that the burning diesel fuel would ignite grass fires outside the cleared 500’ x 500’ fuel storage location. Given the remote and isolated location of the site the impact to the public would be nil.

Diesel fuel is classified as a “combustible liquid”, which is a lower risk rating than the “flammable liquid” classification used for gasoline. The flash point for diesel fuel is relatively higher than that for gasoline, and sparks or static charges are not sufficient to ignite diesel vapors. However, diesel fuel is relatively difficult to extinguish once ignited.

A somewhat more likely scenario is that such catastrophic failure would cause the contents of both vessels to spill into the containment tank and overflow onto the ground, where excess fuel would be impounded within the earth containment berm. Emergency response procedures would be activated. Under either scenario the impacts of such releases to the public would be nil because of the remote and isolated location of the site.

Operations Spill Prevention, Containment and Control Plan

An Operations Spill Prevention, Containment and Control Plan will be developed and submitted to EFSEC prior to the commencement of Project operations. Operation of the Project will not require the storage or use of significant quantities of fuel or other materials that could cause a spill or other accidental release.

Project operations will not require the use of a permanent fuel storage tank, as fuel use during operations is limited to maintenance vehicle fueling which will be done at existing licensed gas stations in nearby communities (Ellensburg or Cle Elum.) The potential for accidental spills during Operations is minimal, as the only materials used during Project operations that present any potential for accidental spills are lubricating oils and hydraulic fluids used in the wind turbine generators and transformers.

Wastes

Operation of the Project will not result in the generation of regulated quantities of hazardous wastes. As no fuel is burned to power the wind turbine generators, there will be no spent fuel, ash, sludge or other process wastes generated. The primary type of waste generated by operations the Project will be municipal solid waste generated at the Operations and Maintenance facility, consisting of typical office wastes (paper, cardboard, food waste, etc.) which will be stored in a dumpster until it is hauled to the transfer station.

Periodic changing of lubricating oils and hydraulic fluids used in the individual wind turbine generators (WTGs) will also result in the generation of small quantities of these materials. These waste fluids will be generated in small quantities because they need to be changed only infrequently, and the changing of these fluids is not done all at once, but rather on an individual WTG basis. These waste fluids will be stored for short periods of time in appropriate containers at the O&M facility for collection by a licensed collection service for recycling or disposal. Procedures for collecting, storing and transporting these materials for recycling or disposal are described in detail in below.

The replacement fluids will be stored on a concrete surface inside the O&M facility and will be surrounded by a catch-basin berm or trough to trap any leaks or spills. Specific details of the volumes of the containment structure(s) will be addressed in the operations spill prevention plan to be submitted to EFSEC for review and approval.

Wind Turbine Fluids
Each turbine model has different specifications for lubricating oil and hydraulic fluid quantities. There are three main types of fluid in a wind turbine generator (WTG): Cooling fluid for the generator (a mix of glycol and water, similar to that used in automobile radiators), lubricating oil for the gearbox (typically a synthetic lubricating oil), and hydraulic oil for operating the blade pitch system, yaw mechanism and brakes. The approximate volumes of fluids contained in the various WTG scenarios for the Project are listed below in Table 3.16.2-2.

All of the WTGs being considered for this Project are equipped with sensors to automatically detect loss in fluid pressure and/or increases in temperature which enable them to be shut down in case of a fluid leak, as well as fluid catch basis and containment systems to prevent any accidental releases from leaving the nacelle. Based on the limited quantities of fluids contained in the WTGs and the leak detection and containment systems engineered into their design, the potential for an accidental spill from WTG malfunction is extremely limited. Furthermore, any accidental gear oil or other fluid leaks form the wind turbines will be contained inside the turbine towers which are sealed around the base. As stated in Section 2.2.3, ‘Project Facilities’, both the nacelles and the towers incorporate adequate containment to capture any fluids in the event of a leak or spill. Specific details of the volumes of the containment structure(s) will be addressed in the operations spill prevention plan to be submitted to EFSEC for review and approval.

Turbine Fluid Replacement
The fluids described in the table above are checked by Operations staff periodically and must be replenished or replaced on an infrequent basis (generally less than once per year and sometimes only once every five years.) When replacing these fluids, Operations staff will climb up to the nacelle and remove the fluids in small (typically 5 gallon) containers and lower them to the ground using a small maintenance crane built into the nacelle itself. The containers are then transferred to a pickup truck for transport to the O&M facility for

temporary storage (typically less than one month) before being picked up by a licensed transporter for recycling. Replacement fluids are added in the same method, only in reverse. Small quantities of replacement fluids, typically no more than a few 50 gallon drums, of lubricating oil and hydraulic oil may be stored at the O&M facility for replenishing and replacing spent fluids. These fluids will be stored indoors in appropriate containers. All Operations staff will be trained in appropriate handling and spill prevention techniques to avoid any accidental spills. Because only small quantities of fluids are transported, added or removed at any one time and are stored for short periods of time, the potential for an accidental spill during routine maintenance is extremely limited.

Pad Mounted Transformers:
As described in Section 2.2.3, 'Project Facilities', each wind turbine generator has a pad mounted transformer located at its base. These transformers contain mineral oil which acts as coolant. Each pad-mounted transformer would contain up to 500 gallons of mineral oil under the largest anticipated WTG scenario. The transformer is designed to meet stringent electrical industry standards, including containment tank weldment and corrosion protection specifications. Pad mounted transformers do not typically incorporate a containment structure, as the volume of mineral oil contained in them is much smaller than in the substation transformers and the risk of a spill is minimal.

Substation Transformer(s):
As described in Section 2.2.3, 'Project Facilities', the entire Project will be electrically connected to the grid at the substation which will be equipped with either one or two transformers. Each substation transformer contains up to 12,000 gallons of mineral oil for cooling. The transformer is designed to meet stringent electrical industry standards, including containment tank weldment and corrosion protection specifications. The substation transformers are equipped with an oil level sensor that detects any sudden drop in the oil levels, and sends an alarm message to the central SCADA system. Finally, the substation transformers are surrounded by a concrete berm or trough to ensure that any accidental fluid leak does not result in any discharge to the environment. The substation transformers will be surrounded by a containment berm or trough, as described in detail in Section 2.2, 'Description of the Proposed Project'.

3.16.1.4 Miscellaneous

There are no specific health and safety standards related to the siting of wind energy facilities. The major applicable regulatory standards used in the design of the Project are listed in Section 2.5 of this Application. The standards most related to health and safety regarding the construction an operation of a wind energy facility and related transmission lines would be the regulations listed in Section 2.5 of this Application as, "Aviation Regulations and Lighting", "Electrical Construction Permit" and "Building Codes"

<u>*No Radiation from Wind Power Project*</u>

Pursuant to WAC 463-42-115 the Applicant requests a waiver of WAC 463-42-352(5), requiring information related to radioactivity. No radioactive materials will be used, consumed, or released during construction or operation of the Project.

Potential for Encountering Contaminated Soils

Applicant commissioned KTA of Seattle, WA to conduct a Phase I Environmental Site Assessment (ESA) of property to be developed as part of the Wild Horse Wind Power Project. The objective of the ESA was to identify and characterize obvious or potential environmental concerns that may exist at the site. To accomplish this objective, a Phase I ESA was performed focusing on a review of environmental records, including information on the physical setting, historical use, and known environmental hazards near the Site. KTA performed a Phase I ESA in conformance with the scope and limitations of ASTM Practice E 1527. This assessment revealed no evidence of environmental impairment within the Project area. Based on these findings, it is not anticipated that any environmental contamination will be encountered during construction or operation of the Project. In the unlikely event that contaminated soils are encountered, Applicant will coordinate with appropriate personnel at Department of Ecology to determine an appropriate action plan in compliance with CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act of 1980) and MTCA (Model Toxics Control Act of 1988).

Shadow Flicker

Shadow flicker, or strobe effects, can occur only if the turbine is located in close proximity to a receptor and is in a position where the blades interfere with very low-angle sunlight. The Project is not expected to result in any shadow flicker effects to any sensitive receptors, such as residences, due to the distance of more than 9,000 feet to the nearest residence which is well beyond the distance at which shadow flicker can cause impacts. A detailed discussion and analysis of the Project's potential to create shadow flicker and any potential health effects in included in Exhibit 9, 'Shadow Flicker Briefing'. Applicant is not aware of any evidence or studies that indicate that shadow flicker affects animals.

Wind Power Project Safety Standards

Construction and operation of a wind energy facility would create some potential for health and safety hazards common to constructing, operating and maintaining large electromechanical systems. These hazards are well documented and systems of design and construction standards to mitigate these hazards have evolved to a large extent.

The wind turbines proposed for the Project meet international engineering design and manufacturing safety standards. This includes tower, blade and generator design. There is an international quality control assurance program for turbines, and a number of relevant safety and design standards. The lead organization for development of international standards for wind turbine generating systems is the International Electrotechnical Commission (IEC), and the most broadly applied standard covering machinery and structures is IEC 61400-1: '*Wind Turbine Generator Systems – Part 1: Safety*

Requirements' (IEC Edition 2 1999). In the U.S., the American Wind Energy Association (AWEA) is the designated organization for participation on IEC committees.

Independent agencies are retained by wind turbine manufacturers to certify that the design and construction of a given turbine/tower assembly conform to accepted standards in terms of design load assumptions, construction materials and methods, control systems and safety measures. This is a generalized type of certification provided at manufacturers' expense. Once a specific system make and model are selected, the user then customarily funds a second independent certification attesting to the applicability of the system design and construction to the site-specific conditions. In addition, foundation design and commissioning checks address potential failure due to extreme events such as earthquakes or extreme wind loadings, as well as frequency tuning of the different parts of the structure to avoid failure due to dynamic resonance.

International experience to date has indicated very low risks associated with tower collapse, components falling from towers, ice throw and blade throw. Despite the very rare destruction of a wind turbine, no member of the public has ever been killed or injured by a wind turbine other than a parachutist in Germany who jumped into one. Risks have been continually reduced as turbine technology has improved. Publications such as *Wind Power Monthly* and *Wind Stats* provide current information on industrial accidents and failures of components.

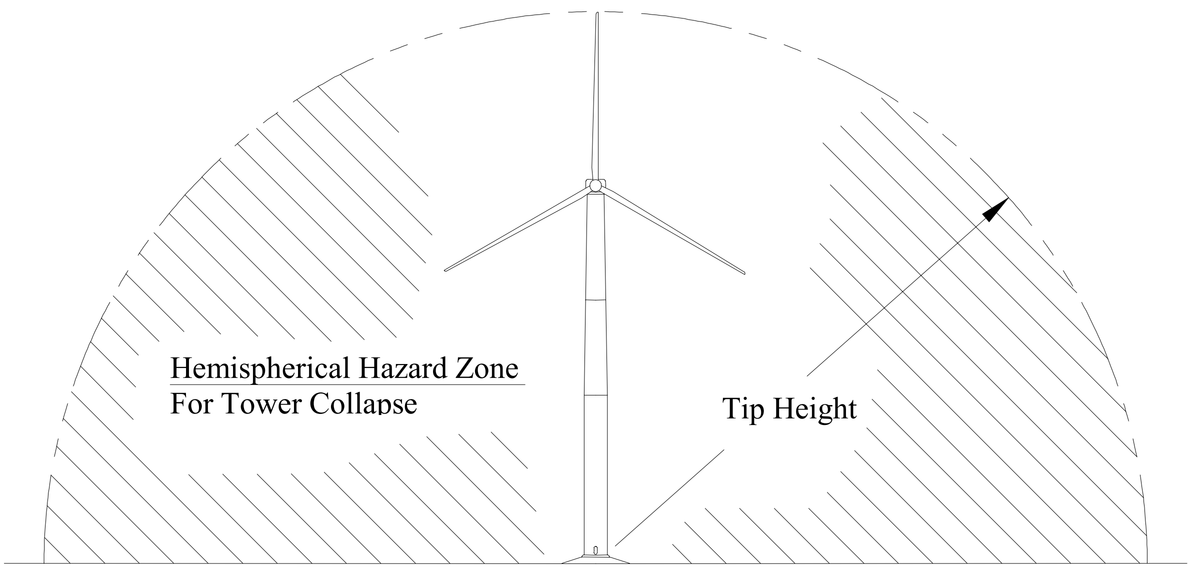
Wind Turbine Tower Collapse

Applicant is not aware of any documented collapse of a tubular tower wind turbine. Turbines and towers are designed to strict standards in order to withstand extreme weather events. Collapse of a turbine tower which has been constructed in accordance with international standards and local building codes is an extremely remote possibility. There is no single agency or entity that is responsible for tracking tower collapse, blade throw, blade icing issues nationally or internationally, however, one very useful source of information on the risks associated with operating wind Projects is the insurance industry. As mentioned in Section 3.16.1.1 above, the Applicant contacted Worldlink Insurance in Palm Springs, CA about the types and degree of risk associated with wind power projects. Worldlink stated that they were not aware of any tubular wind tower structure ever collapsing.

In the extremely unlikely event of a turbine tower collapse, the potential risk to the public is negligible since the Project will be constructed on property with controlled access across private land and the nearest public road is approximately 2 miles away. Persons, animals and facilities within the affected environment could be at risk of being struck by the tower, the nacelle or the turbine rotor blades. A tower collapse onto live electrical circuitry could conceivably start a fire.

Failure of the tower at its base, or of its anchorage to the foundation, would create a hemispherical hazard zone with a radius approximately equal to turbine tip height as illustrated in Figure 3.16.1-2. Tubular steel towers could buckle at some point along their length. This failure mode would result in a smaller hazard zone due to the reduced radius.

Figure 3.16.1-2 Turbine Tower Collapse Potential Hazard Zone



The Project is not expected to result in any tower collapse risk due to the distance of more than 9,000 feet to the nearest residence and 2 miles for the nearest public road to the nearest turbine which far exceeds the maximum tip height of any of the proposed turbines. A summary of the tower collapse hazard zone for the various proposed turbine scenarios is contained in Table 3.16.2-1.

Blade Icing and Ice Throw

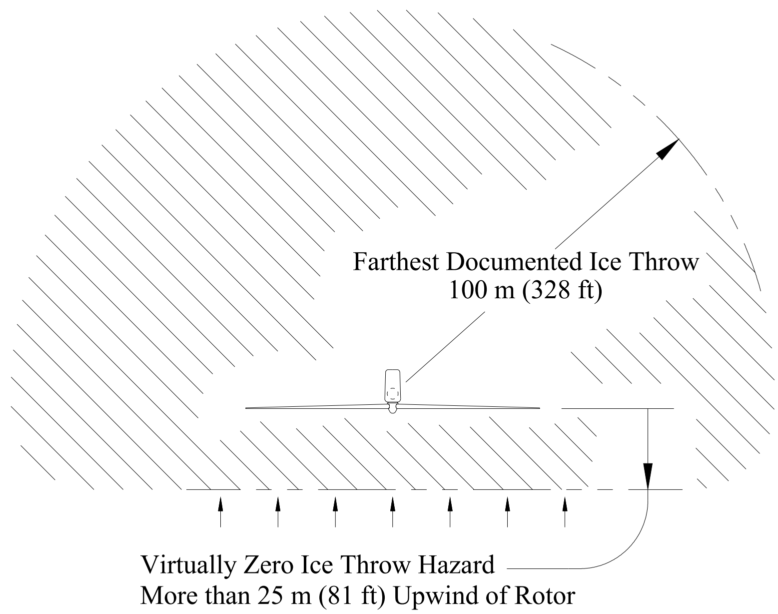
While ice buildup on blades is an occasional problem for wind turbines in terms of lost energy production, flying ice is not. When ice builds up on the blades, the blades turn very slowly (at only several revolutions per minute) until the ice is shed. This is because the airfoil has been compromised by the ice, and the blades are unable to pick up any speed.

It is important to note that while more than 55,000 wind turbine generators have been installed world-wide, there has been no reported injury caused by ice thrown from wind turbines. Studies of long-term weather data for the area by the Applicant's consulting meteorologist, Ron Nierenberg, indicate that icing conditions occur on average 3 to 5 days per year, as outlined in Exhibit 29. This is categorized as a 'Moderate icing' risk according to the 'Wind Energy in Cold Climates' (WECO) study commissioned by the

European Union's Environment Directorate. Reported data on ice throws indicates that ice fragments were found on the ground between 15 and 100 meters (50-328 feet) from turbines and were in the range of 0.1 to 1 kg in mass.

Under certain conditions ice can form on wind turbine towers and rotor blades in a variety of ways. It has been observed that moving rotor blades are subject to heavier buildups of ice than stationary structures through the mechanism of rime icing. Rime icing occurs when a sub-freezing structure is exposed to moisture-laden air with

Figure 3.16.1-3 Blade Ice Throw and Blade Fragment Throw Hazard Zone



significant velocity. If the ice then becomes detached while the blades are rotating, there is the possibility of "ice throw" over a considerable distance from the turbine.

Because of the large number of variables and the need for established guidelines in risk assessment, WECO has supplemented this modeling effort with continuation of an information outreach program originally initiated by the German Wind Energy Institute (DEWI) and the Finnish Meteorological Institute (FMI). This effort consists of gathering experiential data from a large number of wind turbine operators regarding occurrence of icing, and details of any ice throw events. Findings from this effort were presented by WECO team members at the BOREAS IV wind energy symposium in 1998. Significant findings included that the risk of being struck by ice becomes very small at distances greater than 100 meters from each tower at the proposed facility.

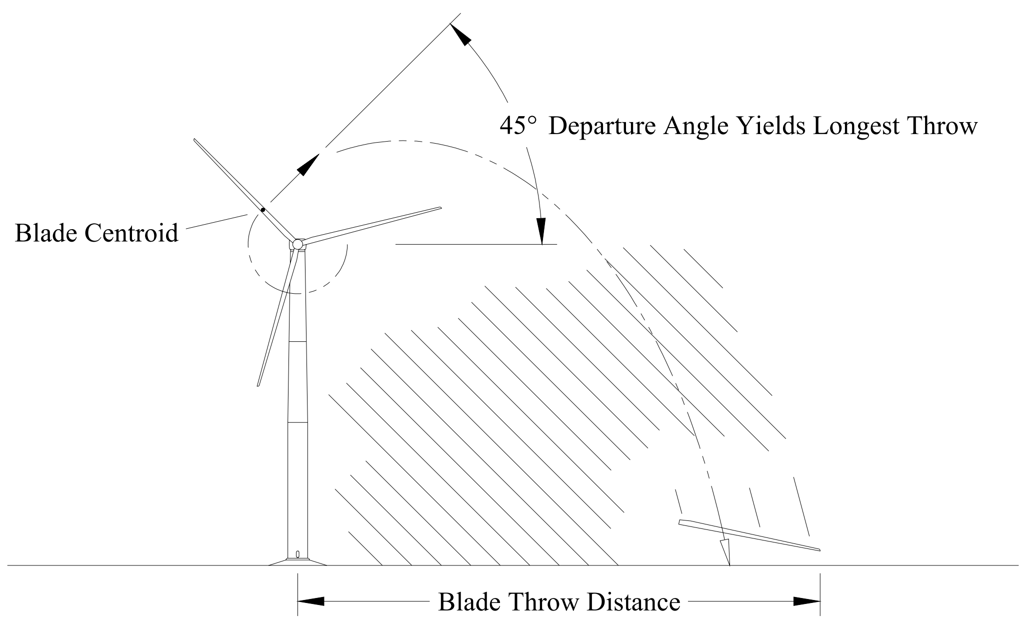
The ice throw hazard area extends in a direction normal to the prevailing wind direction and downwind from the turbine and there is essentially zero ice throw hazard as little as 25 meters upwind from the plane of the rotor as illustrated in Figure 3.16.1-3.

Persons, animals and facilities within the ice throw hazard zone of approximately 100 meters (328 feet) could theoretically be at risk of being struck by an ice fragment. The Project is not expected to result in any ice throw risk given distances of more than 9,000 feet to the nearest residence and 10,000 feet to the nearest public road. These distances far exceed the maximum ice throw potential of any of the proposed turbines. A summary of the tower ice throw hazard zone for the various proposed turbine scenarios is contained in Table 3.16.2-1.

<u>*Blade Throw*</u>

An extensive literature search on this potential hazard indicated that no advanced analytical modeling has been accomplished; this is likely due to the complexity of the analysis, coupled with the extremely low incidence of blade throw reports. Only two

Figure 3.16.1-4 Blade Throw Distance



incidents of blade throw are known. One was the directly linked to improper assembly, resulting in immediate failure upon startup and the other resulted from a blade being struck by lightning.

The simplified worst-case loss of a whole blade would occur with the blade rotating at maximum speed, when oriented at 45º from the horizontal axis and rising. This is the classic maximum trajectory case from standard physics texts as illustrated in Figure 3.16.1-4. Review of these data indicates that for the maximum turbine envelope, the worst-case blade throw distance is approximately one turbine tip-height.

Persons, animals and facilities within the blade throw hazard zone could theoretically be at risk of being struck. The Project is not expected to result in any blade throw risk due to the distance of WTGs from residences and public roads as discussed in the '*Blade*

Icing and Ice Throw' section above. A summary of the tower blade throw hazard zone for the various proposed turbine scenarios is contained in Table 3.16.2-1.

<u>Blade Fragment Throw</u>
Similar to ice throw concern, is the potential of a blade fragment throw. Lightning strikes causing blade failure have been documented. Acts of vandalism such as gun shots could also conceivably damage rotor blades causing a blade fragment to be thrown.

Persons, animals and facilities within the blade fragment throw hazard zone could theoretically be at risk of being struck. The Project is not expected to result in any blade fragment throw risk due to the distance of WTGs from residences and public roads. The distances presented for ice throw in Figure 3.16.1-3 provide a reasonable approximation of the hazard zone for blade fragment throw.

3.16.2 Comparison of Impacts of the Proposed Scenarios

The health and safety impacts of the various proposed turbine scenarios for the Project are summarized below in Table 3.16.2-1, and in the quantities of fluids used in each type of WTG as summarized below in Table 3.16.2-2.

Table 3.16.2-1: Summary of Wind Turbine Hazard Zone Distances

	104 Turbines 3 MW each (Large WTG Scenario)	**136 Turbines 1.5 MW each (Most Likely Scenario)**	**158 Turbines 1 MW each (Small WTG Scenario)**
Max Turbine Tip Height	125 m (410 ft.)	105 m (344 ft.)	90 m (295 ft.)
MAX Tower Collapse Hazard Zone Distance	125 m (410 ft.)	105 m (344 ft.)	90 m (295 ft.)
Estimated MAX Blade Throw Distance	125 m (410 ft.)	105 m (344 ft.)	90 m (295 ft.)
Estimated MAX Ice / Blade Fragment Throw Distance	100 m (328 ft.)	100 m (328 ft.)	100 m (328 ft.)

Table 3.16.2-2: Approximate Fluid Quantities for Wind Turbine Generators Under Different Scenarios

Turbine Component	**Fluid Type**	**Large WTG Scenario**	**Most Likely Scenario**	**Small WTG Scenario**
Gearbox lubrication	Lubricating oil	110	90	70

(gal)				
Generator cooling system (gal)	Glycol-water mix	55	40	30
Hydraulic systems (blades, brake, yaw, etc.) (gal)	Hydraulic oil	85	65	45

3.16.3 Impacts of No Action Alternative

Under the No Action Alternative, the Project would not be constructed or operated, and the environmental impacts described in this ASC would not occur. The No Action Alternative assumes that future development would comply with existing zoning requirements for the Project area, which is zoned Commercial Agriculture and Forest and Range. According to the County's zoning code, the Commercial Agriculture zone is dominated by farming, ranching, and rural lifestyles, and permitted uses include residential, green houses and agricultural practices. Permitted uses in the Forest and Range zone include logging, mining, quarrying, and agricultural practices, as well as residential uses (Kittitas County 1991). However, if the proposed Project is not constructed, it is likely that the region's need for power would be addressed by user-end energy efficiency and conservation measures, by existing power generation sources, or by the development of new renewable and non-renewable generation sources. Baseload demand would likely be filled through expansion of existing, or development of new, thermal generation such as gas-fired combustion turbine technology. Such development could occur at conducive locations throughout the state of Washington.

A baseload natural gas-fired combustion turbine would have to generate 67 average MW of energy to replace an equivalent amount of power generated by the Project (204 MW at 33% net capacity). (An average MW or "aMW" is the average amount of energy supplied over a specified period of time, in contrast to "MW," which indicates the maximum or peak output [capacity] that can be supplied for a short period.) See Section 2.3, 'Alternatives'.

3.16.4 Mitigation Measures

A broad array of measures are proposed to mitigate the potential hazards associated with the Project and the exposure of persons, animals and facilities to the hazards. These measures can generally be classified as preventive, exclusionary or corrective actions.

3.16.4.1 Prevention

Primary among the means of preventing hazards described herein will be adherence to appropriate design and construction protocols such as IEC 61400-1. This will assure that the load assumptions, design, construction standards and safety features are in accordance with industry norms and benefit from the experience of many manufacturers and operators.

A second important form of prevention is the establishment of a skilled workforce, implementing effective facility-wide maintenance, monitoring, compliance, and security programs.

3.16.4.2 Exclusion From the Affected Area

Every hazard identified herein decreases as some function of distance. In many cases, therefore, it is possible to reduce or eliminate hazards to persons and facilities by prohibiting or controlling presence in the area potentially affected by the hazard. Where multiple hazard areas overlap, the largest distance should govern. The fact that all of the Project facilities will have controlled access across private land will facilitate the limiting of access to the facility to persons aware of safety setbacks and potential risks.

3.16.4.3 Failure of Machinery and/or Structures

Wind turbine generators are equipped with multiple safety systems as standard equipment. As examples: rotor speed is controlled by a redundant pitch control system and a backup disk brake system; critical components have multiple temperature sensors and a control system to shut the system down and take it off-line if an overheating condition is detected. Lightning protection is standard on the turbines and a specially engineered lightning protection and grounding system will be installed for the Project as described more fully in Section 2.2.4.

Tower Collapse

The selected wind turbine generator/ tower combination will be subjected to engineering review to assure that the design and construction standards are appropriate for the Project. This review will include consideration of code requirements under various loading conditions and give a high degree of confidence of structural adequacy of the towers. The turbines have been sited at locations more than 9,000 feet from the nearest residence and more than 2 miles from public roads, which far exceeds a reasonable set-back requirement of one tip-height.

Blade Throw

Certification of the wind turbine to the requirements of IEC 61400-1 will assure that the static, dynamic and defined-life fatigue stresses in the blade will not be exceeded under the combined load cases expected at the Project site. The standard includes safety factors for normal, abnormal, fatigue and construction loads. This certification, together with regular periodic inspections, will give a high level of assurance against blade failure in operation. Proposed WTG locations far exceed a reasonable set-back requirement of one tip-height.

3.16.4.4 Ice Throw

Ice throw over 100 m has never been documented as a hazard and no ice throw injury has ever been reported from any existing wind power projects. Icing is a rare event and the turbines are situated in a very remote area. The turbines have been sited at locations which far exceed the reasonable set-back requirement of 100 meters (328 feet).

3.16.4.5 Fire Hazard Mitigation

As some portions of the Project area are currently outside of existing fire districts, it is anticipated that the Applicant will enter into contract(s) for fire protection with local service providers during Project construction. This is discussed further in Section 3.13.1, 'Public Services and Utilities/Recreation - Existing Conditions'. Applicant has begun discussions with Rural Ellensburg Fire District #2 for providing fire protection service under contract during the construction period. Applicant will work with EFSEC, the Kittitas County Fire Marshal and other appropriate agencies to develop and implement a Fire Protection and Prevention Plan listing requirements that will mitigate fire hazards associated with the Project prior to construction. Section 3.16.1, 'Health and Safety' discusses sources of potential fire and explosion along with their risk of occurring.

Construction and operations staff will be given appropriate fire safety training and a work plan that minimizes the risk of fire will be implemented. This would be defined in cooperation with relevant agencies as part of the emergency response plan to be submitted to EFSEC for review. EFSEC, as well as local emergency response organizations, where appropriate, will review and approve all plans before they are implemented. Fire suppression equipment will be made available to designated employees trained in the use of the equipment. The Construction Manager will be responsible for staying abreast of fire conditions in the Project area and for implementing any additional fire precautions as necessary.

Normal operation and maintenance of the Project equipment includes review of real time and stored temperature sensor readings which will highlight developing problems and facilitate prevention of equipment-caused fire. During both operation and construction, all staff working on turbines will work in pairs for safety.

Table 3.16.4-1 summarizes potential fire and explosion hazards and mitigation measures that will be implemented to mitigate the specific risks.

Table 3.16.4-1: Fire and Explosion Risk Mitigation Plan

Constr/ Operation (C/O)	Potential Fire or Explosion Source	Mitigation Measures
C & O	General Fire Protection	• All on-site service vehicles fitted with fire extinguishers • Fire station boxes with shovels, water tank sprayers, etc. installed at multiple locations on-site along roadways during summer fire season

Table 3.16.4-1: Fire and Explosion Risk Mitigation Plan		
Constr/ Operation (C/O)	**Potential Fire or Explosion Source**	**Mitigation Measures**
		• Minimum of 1 water truck with sprayers must be present on each turbine string road with construction activities during fire season
C & O	Dry vegetation in contact with hot exhaust catalytic converters under vehicles	• No gas powered vehicles allowed outside of graveled areas • Mainly diesel vehicles (i.e. w/o catalytic converters) used on site • Use of high clearance vehicles on site if used off-road
C & O	Smoking	• Restricted to designated areas (outdoor gravel covered areas)
C & O	Explosives used during blasting for excavation work	• Only state licensed explosive specialist contractors are allowed to perform this work – explosives require special detonation equipment with safety lockouts • Clear vegetation from the general footprint area surrounding the excavation zone to be blasted • Standby water spray trucks and fire suppression equipment to be present during blasting activities
C & O	Electrical fires	• All equipment is designed to meet NEC and NFPA standards. • Graveled areas with no vegetation surrounding substation, fused switch risers on overhead pole line, junction boxes and pad switches. • Fire suppressing, rock filled oil containment trough around substation transformer.
C & O	Lightning	• Specially engineered lightning protection and grounding systems used at wind turbines and at substation • Footprint areas around turbines and substation are graveled with no vegetation
C	Portable Generators – hot exhaust	• Generators not allowed to operate on open grass areas • All portable generators to be fitted with spark arrestors on exhaust system
C	Torches or field welding on-site	• Immediate surrounding area will be wetted with water sprayer • Fire suppression equipment to be present at location of welder/torch activity
C & O	Electrical arcing	• Electrical designs and construction specifications meet or exceed requirements of NEC and NFPA

3.16.4.6 Security

The Project generally consists of a substation, an O&M building and graveled site access roads which lead to the wind turbines. Security is primarily a function of controlled access to the Project areas and lock-out provisions to major equipment and controls. Much of the security monitoring activities will be straight forward since there is only one site access way to the Project site which will be controlled both during construction and operations.

Worldlink Insurance, a leading insurer of wind power projects around the world, surveyed 15 years of data for more than 17,000 WTGs operating in 14 different countries. Worldlink reported that there were no recorded cases of terrorism, sabotage or other similar security threats. Vandalism occurred on some wind power projects which was generally limited to petty theft of tools and/or equipment.

A security plan will be implemented during Project construction. Upon completion, a comprehensive operations security plan will be prepared along with a detailed emergency plan which is more fully described in Section 4.6, 'Emergency Plans'.

<u>*Construction Phase Security*</u>

Security Plan:
The Site Project Manager will work with a security contractor to develop a plan to effectively monitor the overall site during construction, including drive-around security and specific check points. EFSEC, as well as local emergency response organizations, where appropriate, will review and approve all plans before they are implemented. The security inspection and monitoring plan will be modified as appropriate during construction, based on the level of construction activity and amount of sensitive or vulnerable equipment in specific areas. Site access will be controlled and all on-site construction staff and visitors will be required to carry an identification pass.

Secured Lay-down Areas:
Construction materials will be stored at the individual turbines locations, or at the lay-down area around the perimeter of the Operations and Maintenance (O&M) facility and site construction trailers. Temporary fencing with a locked gate may be installed at the lay-down areas for storage of equipment or materials.

<u>*Operational Phase Security*</u>
Site visitors including vendor equipment personnel, maintenance contractors, material suppliers and all other third parties will require permission for access from authorized Project staff prior to entrance. The Plant Operations Manager, or designee, will grant access to any critical areas of the site on an as-needed basis. Site access will be controlled and all visitors or contractors on the site will be required to carry an identification pass.

Both the O&M facility and the main substation will be equipped with outdoor lighting and motion sensor lighting. The main substation will be also visible from the O&M facility. The substations will be surrounded by an 8 foot tall chain-link fence with barbed wire along the top and locked gates. All wind turbines, pad transformers, pad mounted switch panels and other outdoor facilities will all have secure, lockable doors.

The plant operations group will prepare a detailed security plan to be implemented to protect the security of the Project and Project personnel. EFSEC, as well as local emergency response organizations, where appropriate, will review and approve all plans before they are implemented.

3.16.5 Significant Unavoidable Adverse Impacts

With the possible exception of adverse indirect impacts created by lightning, all of the health and safety environmental impacts addressed herein which derive from the electromechanical nature of the Project can be mitigated by prevention, safety zone setbacks and proper operating procedures.